SPLICING VEHICLE

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SPECIFICATION

BACKGROUND OF THE INVENTION

The present invention relates web splicers which form an automatic flying splice between a new roll and a web of material running from an expiring roll. More particularly, it is directed to a vehicular transporting and splicing apparatus for rolls of web material wherein a single apparatus may service several unwinding devices. The primary use for the present invention is likely to be printing and converting paper and plastic film, although other materials and uses may be handled using the present technology.

The present manual unwind stand operations on smaller web presses without splicers proceed as follows: when an unwinding roll is essentially depleted, the printing press is stopped, and the web connected to the web-consuming machine is manually severed from the remainder of the roll. The roll and coreshaft assembly is then manually lifted from the unwind stand. A new roll on a dolly is then moved next to the unwind stand and levered up into the unwind position, where it is then hand spliced onto the severed end of the web. The press is restarted and after several minutes of continuously producing waste, production resumes.

These manual operations are time-consuming, wasteful, arduous and injury-prone.

To avoid downtime of the web-consuming machine, two main concepts have been used to design a splicer to connect a new roll to the running web, especially on printing presses. Some use a festoon to store a sufficient length of web to allow a stationary splice to be made, while the depleting festoon continues to supply a moving web.

Other types of splicers, referred to as flying splicers or speed match splicers, make a splice automatically at operating speed by matching the surface velocity of the new roll to that of the expiring web, and rapidly adhering the end of the outer wrap of the new roll onto the expiring web. Most speed match splicers utilize a surface drive on the new roll. This requires that one or two areas across the width of the web be free of adhesive, which allows the high-velocity air used in most dryers to enter this slot in the splice, inflating it and often causing a web-break. Examples of prior art are:

McDonald U.S No. 3,740,296, teaches the use of pivoted arms to support rolls.

Phelps U.S.No. 3,831,876, teaches a core chuck driven roll, and describes the splicing mechanism and ability to splice either the inside or outside of the paper facing upward.

Tafel U.S. No. 4,729,522, uses a surface belt drive with the disadvantage mentioned above, of not having a continuous adhesive pattern across the face of the new roll.

To overcome on this particular objection, the present invention drives the roll by its coreshaft. An example of this general type of splicer is taught in Martin 5,335,870 which is especially useful for printing presses having only one or two webs, or which are fed at right angles to the pressrow by web turning bars.

Both types of splicing machines are quite large, occupying a volume many times that of the rolls they process. When used with printing presses and converting lines, it is often necessary to reconfigure the entire operation to provide sufficient additional space these splicers and space to load them. Further, there is considerable expense involved, as one splicer must be provided for every web, and in newspaper applications, multiple webs are customary. Another means of solving the floor space problem has been to stack splicers on top of one another, but this requires operators to climb ladders and work off of platforms, hoisting devices on rails, and all the webs must be strung down to floor level and under the presses.

SUMMARY OF THE INVENTION

The present invention is small and portable, requiring little or no change to the press arrangement, only a speed sensor and dispensing roll diameter sensor on the we utilizing device, and locating disks in the floor. The apparatus may be computer controlled to automatically retrieve and move a new roll into a position next to the dispensing roll, to then splice the new roll with the exiting web from the dispensing roll, and to replace the depleted dispensing roll with a new dispensing roll, without interrupting the web supply. Of particular advantage is the ability of this portable splicer to consecutively service unwind devices on a variety of web utilizing devices. Optional provision is made to retain the rotational direction of the actively unwinding roll before and after splicing, a common requirement when using paper having different finishes on each side.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made in the foregoing description to paper and printing, but the same concepts and apparatus may be applied to many different web consuming operations. In the detailed description of the invention which follows, reference will be made to the accompanying drawings composed of the following figures:

Fig. 1 is a pictorial view of the splicer vehicle in its preferred embodiment, showing the splicer vehicle conveying an expired roll. The splicehead arms are raised.

Fig.2 is a pictorial view of the splicer vehicle in its preferred embodiment, conveying a roll into position adjacent to an unwind located under a small printing press.

Fig.3 is a front view of the splicer vehicle at the beginning of a splice cycle, showing the web from a dispensing roll being spliced onto a new roll .

Fig. 4 is a front view of the splicer vehicle in its preferred embodiment, showing its roll lifting arms having moved the newly-spliced roll into dispensing position after having lifted the expired roll up out of the way.

Fig. 5 is a detailed pictorial view of the new roll, the web-repositioning idler-roller, severing knife, and splicehead positioning arm, immediatly after a splice. The view is shown truncated at the centerline

Fig. 6 is a pictorial view showing the roll lifting assembly about to move down and engage the coreshaft of a new replacement roll.

Fig. 7 is an pictorial view of the roll lifting assembly and engaging mechanism in its locked position.

Fig. 8 is a pictorial view of the splicer vehicle adapted to load stacked rollstands.

Fig. 9 is a pictorial view of the splicer vehicle adapted to function with core chucks, rather than a coreshaft. The splicer vehicle is shown conveying a new roll. Th splicehead arms are raised and each shown engaging a core chuck.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to apparatus to form a flying splice wherein new-rolls of material are supported within a vehicle equipped with a lifting mechanism to lift and position new-rolls, and incorporating a splicing mechanism to splice the outer wrap of material onto expiring rolls in at least one unwind stand. Optional provision is made to retain the rotational direction of the actively unwinding roll before and after splicing, an advantage when using paper having different finishes on each side.

Although the following terminology refers primarily to printing and paper, it must be understood the present invention is applicable to any of a variety of web-consuming devices or materials.

The sequence of operation for the present invention as it applies to paper and plastic film is generally as follows:

In a web printing or converting production line, a web utilizing device is provided with a web from a splicer, or from an unwind stand. In the case of an unwind stand, the present invention provides a means to automatically splice a new roll onto the dispensing roll in the unwind stand, thereby supplying a continuous, uninterrupted web supply to the web utilizing device without the expense of having a splicer for each web.

When it is determined, either visually, or by automatic sensing devices, that the roll dispensing a web is substantially depleted the present invention provides a vehicular splicer to retrieve a new roll from a storage area and to splice a web from that roll onto the web of the roll being dispensed.

The new roll must first be unwrapped and a coreshaft inserted and locked into the hollow core of the new roll. A pair of parallel roll lifting arms then extend from the splicing vehicle and engage each end of the coreshaft and lift it off the floor and into the interior of the vehicle for transport to a predetermined location next to the roll unwind. Pins are then lowered from the splicing vehicle into sockets in the floor, accurately locating the vehicle. When the dispensing roll is depleted sufficiently to allow a splice, the roll lifting arms extend to move the new roll from the vehicle until the circumferences of the new roll and the dispensing roll are less than approximately two inches apart and parallel. The splicehead arms then lower the splicing mechanism down over the coreshaft of the dispensing roll. The new roll is then rotated to a surface velocity approximating the velocity of the dispensing web, at which time the splicing roller brackets are pivoted to redirect the dispensing web out of the roll unwind device and against an adhesive area on the outer wrap of the new roll, thereby effecting a splice.

A severing knife then detaches the splice from the expired roll. The new-roll drive motor goes into a braking mode responsive to a web tension indicated by a web-tension sensor mounted in the unwind stand, and maintains w b tension at a operator established set-point until the roll is mov d into position in th unwind stand web, at which time tensioning is provided by the braking means normally provided by the unwind stand.
The expired roll is then removed from the press, the roll support arms are retracted, and the vehicle is moved away from the press, supported on its wheels.

Referring now to pictorial view **Fig.1** of the splicer vehicle in its preferred embodiment, showing the splicer vehicle **4** conveying a new roll **30** which is loaded into the roll lifting arms **8**. The splicehead arms **17** are raised.

Referring now to pictorial view **Fig.2** , the preferred embodiment is shown moving into a splicing position adjacent to a small web press **1** of common design having an unwind stand **2** beneath it.

Fig.3 is a front view at the beginning a splice cycle. New roll **37** illustrates the smallest new roll that may be accommodated, and new roll **30**, shown in phantom lines, illustrates the largest roll that may be accommodated.
The roll-lifting arms **8** with their roll retaining latches activated by actuators **36**, have been moved into the splice position by the rotation of pivoting arms **7**. The splicehead-arms **17**, each having a splice roll bracket **20** operated by actuator **21,** acting in combination, support the splicehead shaft **46** at each of its ends, including the resilient splicing roller **18** and severing knife **42** supported thereby. The splice roll bracket **20** is shown is shown (in bold lines) as the splicing roller first contacts dispensing web **29** and also in a second position, in phantom lines, after it has rotated approximately 90 degrees of revolution to press the dispensing web against the adhesive area on the new roll **37**, thereby effecting a splice between the web from the dispensing roll and the outer wrap of the new roll. Operative rotation of severing knife **42** by shaft **46** then detaches the web from the dispensing roll in the unwinding stand to complete the splice cycle, whereupon the splicehead arms and splice roll bracket **20** acting in combination with the splicing roll **18**, grasp and remove this roll from rollstand support bearing **17** to the location shown over the top of the vehicle.

Referring now to front view **Fig.4**, the pivoting arms **7** and lifting arms **8**, move collectively and in unison to place the new roll coreshaft **19** and new roll **30** into bearing saddl s **24** . Acting collectively and in unison, brake arms **38** then operatively rotate together and cause the brake pads **27** support d thereby, to grasp brake drum **28** and thereby restrain its rotation, and causing tension to be maintained in the dispensing web **29**.

Pictorial view **Fig. 5** shown truncated at the centerline of the apparatus, illustrates the splicing elements in enlarged detail. Splicing roller brackets **20** are pivotably supported by splicehead arm **17**, and are caused to pivot by splicing roll linear actuator **21**. Shaft **46** rotatably supports roller **18** by bearings **47** on which are also positioned splicing roller brackets **20.** Knife **42** is affixed to clamping blocks **45,** which rigidly clamp onto operatively rotatable shaft **46**. Upon operative rotation of said shaft, the dispensing web is severed. The hooked shape of bracket **20** aids in confining and subsequently grasping the coreshaft **19.**

Fig. 6 is a pictorial view showing the roll lifting assembly just prior to moving down and engaging the coreshaft **19** of a new replacement roll **30**. Actuator **36** has retracted, which rotates triangular block **35** Counterclockwise about pin **26.** Toggle link **34** which is rotatably attached to the triangular block , pulls on roller link **32**, causing it to rotate into an open position to accept the coreshaft **19**.

Fig. 7 is an pictorial view of the roll lifting assembly in the clamped condition. The coreshaft is omitted for clarity. Actuator **36** has extended, rotating triangular block **35** clockwise about pin **26.** Toggle link **34** which is rotatably attached to the triangular block , pushes on roller link **32** and toggles over-center, causing the roller link to rotate into a closed position to grasp the coreshaft **19**, and to remain locked in that position in the even the energy source to the actuator is accidentally interrupted. The coreshaft is supported between rollers **31**, which are arrayed in a triangle.

Fig. 8 shows a two-high stacked rollstand being serviced by a modification of the basic design, wherein the lifting and splicing mechanism is supported on an elevating track mechanism. A significant advantage of the present invention is that, after the new roll is loaded into the splicing vehicle, the splicing and core retrieval process requires no operator.

Pictorial view **Fig. 9** of the splicer vehicle, shows the splicer vehicle **4** conveying a new roll **30** having core chucks **48** inserted into each end of the roll core. Core chucks are commercially available of various designs. One type is the so-call self-actuating chuck which has a torque sensitive mechanism that expands the chuck inside the roll core responsive to a driving or braking torque, Other types of chucks are operated either mechanically or by pneumatics. In the present invention, the core chucks are being rotatably supported in roll lifting arms. The chuck arms **47** with chuck bearing housing **49** are shown raised, with each arm holding a core chuck for subs quent insertion into a new roll.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.